

## Image Reading Apparatus

### BACKGROUND OF THE INVENTION

#### Field of the Invention

5           This invention relates to an image reading apparatus provided with a reading member such as a CCD and for reading the image of an original.

#### Related Background Art

10           Figs. 5 and 6 of the accompanying drawings show an image reading apparatus which is the background art of the present invention. This apparatus is an apparatus in which an original is moved and the image of the both sides of the original are read, and has first image reading means for reading the lower surface of the  
15           original, and second image reading means for reading the upper surface of the original, and can read the images of the both sides of the original at a time. When sides is to be effected, the original is automatically fed with the first image reading means  
20           fixed, and lights are applied from discrete light sources to the both sides of the original being conveyed, and the reflected lights are received and the images are read.

25           As shown in Fig. 5, the original placed on an original stacking plate 100 is pulled into the apparatus by a pulling-in portion. The pulled-in original is moved by a separating roller 101, a

discharge roller 102 and a driven roller 103. In the  
meantime, the front surface of the original is  
illuminated by a lamp 104, and the optical information  
of the original is directed to a lens 106 by a mirror  
105. The lens 106 converges the optical information of  
the original and applies it to a CCD 107. The optical  
information which has entered the CCD 107 is converted  
into an electrical signal and as the result, the  
information of the front surface of the original is  
read by the CCD.

Further, design is made such that when jam occurs  
during the conveyance of the original, a reading unit  
can be pivotally moved about a hinge 108 to open a  
portion of a conveying path so that a user can smoothly  
carry out jam treatment (see Fig. 6).

Now, when the light is applied from the light  
source, heat is generated from the light source and the  
temperature in the apparatus rises. Particularly when  
the upper surface of the original is to be read, the  
upper portion of the apparatus in which the temperature  
is liable to rise is liable to be affected by the heat  
thereof because as a matter of course, the reading  
means is disposed above the original.

Also, in the trend to a higher speed and a higher  
quality of image, the temperature rise of the light  
source lamp has become great. As indicated by arrows A  
in Fig. 5, heated air moves upward and therefore, the

temperature of the CCD which is an image reading member disposed above the light source rises and thus, there has been the possibility that the image cannot be read with good accuracy or in the case of a CCD capable of  
5 reading a color image, the gelatin matter of a color filter melts out and an inconvenience may occur to the CCD.

Also, while as shown in Fig. 6, a reading unit for reading the upper side of the original including an  
10 original upper side conveying path is pivotally moved to thereby open the conveying path and carry out jam treatment and maintenance, there is a case where paper powder and toner adhering to the conveying path or stripped-off toner and dust fall off the conveying path  
15 with the pivotally moving operation and fall downward as indicated by arrow B in Fig. 6. If at this time, the CCD is at a short distance from the center of pivotal movement, the CCD may be located below the locus of the pivotal movement of the conveying path and  
20 therefore, it has sometimes happened that the CCD is stained by the falling paper powder, toner and dust and the image of the original cannot be read accurately.

#### SUMMARY OF THE INVENTION

25 It is an object of the present invention to provide an image reading apparatus in which a reading member is prevented from rising in temperature by the

heat of a light source.

It is another object of the present invention to provide an image reading apparatus in which dust or the like is prevented from adhering to a reading member  
5 during the movement of a reading unit.

It is still another object of the present invention to provide an image reading apparatus comprising first reading means for reading a first surface of an original, and second reading means for  
10 reading a second surface opposite to the first surface of the original, the first reading means and the second reading means being provided on the first surface side and the second surface side, respectively, with the original as the boundary, the second reading means  
15 including a light source and a reading member for reading image light from the original irradiated by the light source, the reading member being provided separately from a vertical line passing through the light source.

It is yet still another object of the present invention to provide an image reading apparatus comprising a unit for reading an original being conveyed, the unit having a reading member for reading  
20 image light from the original, and being openable and closable relative to the main body of the apparatus with an original conveying path as the boundary,  
25 wherein when the unit is opened, the reading member is

located above that portion of the unit which forms the original conveying path.

Further objects of the present invention will become apparent from the following description.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows an image reading apparatus which is an embodiment of the present invention.

10 Fig. 2 shows reading means and the surroundings thereof.

Fig. 3 shows a reading unit as it is opened.

Fig. 4 shows the reading means of an image reading apparatus which is another embodiment of the present invention and the surroundings thereof.

15 Fig. 5 shows an image reading apparatus which is the background art of the present invention.

Fig. 6 shows a reading unit as it is opened.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 Some embodiments of the present invention will hereinafter be described with reference to the drawings.

25 Fig. 1 shows an image reading apparatus which is an embodiment of the present invention, and Fig. 2 shows reading means and the surroundings thereof.

The reference numeral 1 designates a flat bed image reading portion (FB) capable of fixing an

original thereon and reading the image of the original,  
and the reference numeral 2 denotes an ADF (automatic  
document feeder) mounted on the upper surface of the  
FB1, and this is a device for feeding and conveying  
5 original stacked thereon one by one to a predetermined  
reading portion.

The reference numeral 3 designates an original  
glass plate, the reference numeral 4 denotes an optical  
carriage (a lower surface side optical reading unit)  
10 which is first reading means for scanning the original  
on the original glass plate 3, the reference numeral 5  
designates a driving belt for drive transmission for  
moving the carriage 4, the reference numeral 6 denotes  
a carriage driving motor for driving the driving belt  
15 5, the reference numeral 7 designates a lamp which is a  
light source disposed on the upper surface of the  
carriage 4, the reference numeral 8 denotes a  
reflecting mirror for directing reflected light  
reflected from the original by the lamp to a  
20 predetermined optical path, the reference numeral 9  
designates a CCD which is a reading member (a reading  
device or a reading element) for converting an image  
obtained by receiving the light directed by the  
reflecting mirror 8 into an electrical signal, the  
25 reference numeral 10 denotes a condensing lens for  
condensing the light reflected by the reflecting mirror  
8 onto the CCD, the reference numeral 11 designates an

original dashing reference plate provided on the  
original glass plate 3, the reference numeral 12  
denotes an original side regulating plate provided on  
the ADF 2 for effecting the widthwise regulation of the  
5 sheet, the reference numeral 13 designates an original  
stacking tray the reference numeral 14 denotes an  
original length detecting lever disposed on the  
original stacking tray 13 for detecting the lengths of  
the originals, the reference numeral 15 designates an  
10 original presence or absence sensor lever for detecting  
the leading end of the original and detecting the  
presence or absence of the original, the reference  
numeral 16 denotes a weight for holding down the  
leading end of the original from above it, the  
15 reference numeral 17 designates an original shutter for  
preventing the leading end of the original from coming  
into a separating and feeding portion, the reference  
numeral 18 denotes a feeding pickup roller for feeding  
the stacked originals in succession from the lowermost  
20 one, the reference numeral 19 designates a separating  
belt rotatively driven in the direction opposite to the  
conveying direction of the original, the reference  
numeral 20 denotes a feed roller provided in opposed  
relationship with the separating belt 19, the reference  
25 numeral 21 designates a pre-registration sensor lever  
for detecting the leading end of the original and  
taking the timing for making the loop of the original,

the reference numeral 22 denotes a pair of registration rollers, the reference numeral 23 designates an original leading end detecting lever for detecting the leading end of the original conveyed by the registration rollers, and the reference numeral 24 denotes an original conveying upper guide provided in opposed relationship with the original glass plate 3 for causing the originals to be conveyed with the aid of a predetermined gap provided between the original glass plate 3 and the original conveying upper guide and the images thereof to be read. The reference numeral 25 designates a first reading point for reading one side of the original by the carriage 4, and the reference numeral 26 denotes an optical carriage (an upper surface side optical reading unit) which is second reading means provided at a location opposed to the carriage 4 with the original interposed therebetween, and in the carriage 26, there are disposed a reflecting mirror 51 and a CCD 53 similar to those in the carriage 4. The reference numeral 27 designates a second reading point for reading the image of one side of the original by the carriage 26, the reference numeral 28 denotes a pair of discharge rollers for discharging the originals out of the apparatus, and the reference numeral 29 designates a discharge tray for stacking thereon the originals discharged by the pair of discharge rollers 28.



Fig. 3 shows the opened portion of the ADF 2 during jam treatment, and in Fig. 3, the reference numeral 32 denotes a jam treating lever, and the reference numeral 36 designates an ADF jam opening and closing portion adapted to be opened when a jammed original is to be removed. The opening and closing portion 36 is a reading unit containing the second reading means 26 a frame member. The reading unit is openable and closable relative to the main body of the apparatus with the original conveying path as the boundary.

Fig. 2 is an enlarged view for illustrating in detail the reading unit for reading the image of the upper surface of the original.

The reference numeral 50 designates a lamp (an upper surface side light source) for applying light to the upper surface side of the original, and the reflected light from the upper surface of the original by the irradiation by the lamp 50 is directed to a predetermined optical path by a reflecting mirror 51. The light directed by the reflecting mirror 51 then passes through a condensing lens 52 and is condensed onto a CCD (an upper surface side image reading member) 53 which is an image reading member. When the image of the upper surface of the original is to be read, the irradiating lamp 50 applies light thereto and begins to generate heat. The air around the irradiating lamp 50

is heated and moves to above the lamp, and the members and air above it rise in temperature. However, in the embodiment to which the present invention is applied, the CCD 53 is disposed at a location deviating from substantially vertically above the lamp 50, i.e., a location horizontally separate from a vertical line passing through the lamp 50 at an upper position in the vertical line. Therefore, the temperature of the CCD which is an image reading member is not affected by the temperature rise of the lamp 50 and can effect stable image reading.

Fig. 3 further shows a case where the opening of the ADF 2 for jam treatment has been effected. The distance from the hinge 54 which is the pivot to the CCD 53 is longer than the locus of the pivotal movement of the portion 57 of the reading unit which forms an original conveying path and the CCD 53 is located substantially in the same direction as the pivotally moved conveying path forming portion 57 as viewed from the pivot hinge 54 and more adjacent to the opened side than the pivotally moved conveying path forming portion 57 and therefore, the CCD 53 is always located at a position above the conveying path forming portion 57 in the locus of the pivotal movement thereof. That is, when the reading unit (the opening and closing portion) 36 is opened, the reading member 53 is located above the portion 57 of the unit 36 which forms the original

conveying path. Therefore, when the reading unit is pivotally moved for jam treatment or maintenance, paper powder and toner and dust stripped off the original ball to the side opposite to the CCD 53 and thus, the  
5 reading member 53 is not stained.

Fig. 4 is a view for illustrating another embodiment. In this embodiment, members similar to those in the aforescribed embodiment are given similar reference numerals and need not be described.

10 The reference numeral 50 designates a lamp for applying light to the upper surface side of the original, and the reflected light from the upper surface of the original by the irradiation by the lamp 50 is directed to a predetermined optical path by a  
15 reflecting mirror 51. The light directed by the reflecting mirror 51 then passes through a condensing lens 52 and is condensed onto a CCD 53 which is an image reading member. The reference numeral 58 denotes a cover for covering the lamp 50, the CCD 53, etc.  
20 When the image of the upper surface of the original is to be read, the irradiating lamp 50 applies light thereto and begins to generate heat. The air around the irradiating lamp is heated and moves to above the lamp, and the members and the air above it rise in  
25 temperature. In the present embodiment, however, a ceiling surface (light source ceiling portion) 58a which is a first cover portion above the lamp 50 is

higher than a ceiling surface (reading member ceiling portion) 58b which is a second cover portion on the CCD 53 side. Therefore, the air heated by the lamp 50 and having come up does not flow to the CCD side, but  
5 collects below the ceiling on the lamp 50 side. Of course, again in the present embodiment, the reading member 53 is horizontally separate from the vertical line passing through the lamp 50, and the temperature rise of the reading member 53 can be prevented.

10 Further, in the present embodiment, an opening portion 56 is formed in the ceiling (the first cover portion 58a) on the lamp 50 side. The hot air collected as shown in Fig. 4 is exhausted outwardly through the exhaust opening 56 and therefore, it is  
15 more difficult for the temperature of the CCD 53 which is an image reading member to be affected by the temperature rise of the lamp 50 than in the aforescribed embodiment, and more stable reading can be effected.

20 As described above, according to the present invention, the temperature rise of the image reading member such as the CCD by the heat generation of the light source can be suppressed, and it is possible to avoid the trouble due to the temperature rise by high-  
25 speed reading. Also, for example, the gelatin matter of the color filter of the CCD can be prevented from being melted.

Also, even when the optical reading unit is pivotally moved to open the original conveying path during jam treatment, the image reading member is always located above the original conveying path forming portion. Therefore, paper powder, dust, etc. do not fall and come into the image reading portion, and stale and accurate image reading is possible.

While the embodiments of the present invention have been described above, the present invention is not restricted to the above-described embodiments, but all modifications are possible within the technical idea of the present invention.